

CLAIMS

1. An automatic separator/extractor having;
 - conveying means for conveying a vessel mounted at one of a plurality of mounting sections thereof along a closed path,
 - 5 a dispensing section for dispensing a reagent or the like into the vessel mounted on said conveying means,
 - a liquid processing section for removing and/or extracting liquid other than a precipitate inside the vessel mounted on said conveying means,
 - a separator for performing separation with respect to the contents inside a
 - 10 vessel which is mounted on said conveying means and/or a vessel which is installed away from said conveying means,
 - vessel moving means for bringing in and taking out said vessel with respect to the mounting sections of said conveying means and/or separator, and
 - an operation/control section for performing operation and control with respect
 - 15 to said conveying means, said dispensing section, said liquid processing section, said vessel moving means, and said separator,
 - wherein the liquid processing section has: a liquid drawing section, one or a plurality of nozzles communicated with said liquid drawing section, and which can be inserted into said vessel.
 - 20 _____ a vertical movement mechanism for moving in a vertical direction said nozzles or vessel in order to insert said nozzles into said vessel or into each well of said vessel, and a combined incline mechanism for inclining said nozzles and vessel in combination with respect to said vertical axis, in order to incline said vessel and draw in liquid from said nozzles without influencing a precipitate.
- 25 2. An automatic separator/extractor according to claim 1, wherein said separator exerts a centrifugal force on a vessel containing a substance to be separated, and/or exerts a magnetic force on a vessel containing a substance to be separated which is combined with magnetic particles, to thereby perform separation.

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3. An automatic separator/extractor according to claim 1, having an agitating section for agitating the contents of the vessel mounted at the mounting section on said conveying means by vibrating the vessel itself, and said agitating section is operated and controlled by the operation/control section.
- 5 4. An automatic separator/extractor according to any one of claim 1 through claim 3, wherein said vessel is a microplate provided with a plurality of wells, and said conveying means mounts and conveys a plurality of said vessels.
5. An automatic separator/extractor according to claim 1, wherein said conveying means has; a turntable formed in an annulus ring which is rotatable, a plurality of
10 mounting sections for mounting a plurality of vessels on the turntable so as to

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subtend therebetween equally divided base central angles or central angles which are multiples of these, and a rotation drive section for repeatedly rotating and stopping at units of the base central angle in accordance with instructions from said operation/control section.

- 5 6. An automatic separator/extractor according to claim 1, wherein a conveying speed, a conveying direction, a stop interval, a conveying interval, a conveying distance and/or a mounting position for the vessel are set by the operating/control means based on the contents or purpose of a specified process.
7. An automatic separator/extractor according to claim 5, wherein as said
10 separator, a centrifuge is provided adjacent to the inside or outside of said turntable.
8. An automatic separator/extractor according to claim 7, wherein a rotation speed of said centrifuge, a rotation time and a location of a vessel are set by said operation/control section based on a liquid contained in the vessel, the nature or weight of a precipitate or a target substance, and/or the contents or purpose of a
15 process.
9. An automatic separator/extractor according to claim 1, wherein said dispensing section has; a pipette apparatus provided with a group of nozzles, and moving means capable of moving said nozzles between said vessel mounted on said conveying means and a reagent tank provided apart from said conveying means.
- 20 10. An automatic separator/extractor according to claim 1, wherein a reagent tank to be drawn from by said dispensing section, a vessel to be dispensed to, an amount to be drawn or discharged, a speed of drawing up or discharge, a timing or sequence of drawing up or discharge, the presence of insertion or removal of the pipette tips or the timing therefor, the presence or timing of washing, and/or a relationship to
25 movement are set by the operation/control section based on the contents of the indicated process.
11. An automatic separator/extractor according to claim 1, wherein a sensor for detecting liquid level is provided in a reagent tank provided in said dispensing

section, and liquid such as reagent is automatically supplied to said reagent tank in response to said sensor.

12. An automatic separator/extractor according to claim 1, wherein said liquid processing section is provided with a magnet or electromagnet such that poles thereof
5 are positioned outside a bottom or side wall of each well of a mounted vessel.

13. An automatic separator/extractor according to either one of claim 1 and claim 12, wherein said liquid processing section is separately provided with a liquid removal section for removing liquid other than precipitate inside a vessel mounted on said conveying means, and a liquid extraction section for extracting liquid other than
10 precipitate inside a vessel mounted on said conveying means.

14. An automatic separator/extractor according to claim 13, wherein said liquid removal section has; a liquid drawing section, one or a plurality of nozzles communicated with said liquid drawing section, and which can be inserted into said vessel,
15 a vertical movement mechanism for moving in a vertical direction said nozzles or vessel in order to insert said nozzles into said vessel or into each well of said vessel, and a combined incline mechanism for inclining said nozzles and vessel in combination with respect to said vertical axis, and said removal section inclines said vessel and draws in liquid from said nozzles and discharges liquid from an opening of
20 said vessel without influencing a precipitate.

15. An automatic separator/extractor according to claim 1, wherein said liquid processing section has a position adjustment mechanism for adjusting a relative position between tips of said nozzles and inner walls of said vessels in order to contact the tips of said nozzles against the inner walls of said vessels.

25 16. An automatic separator/extractor according to claim 15, wherein said position adjustment mechanism has;

a cylindrical support section for supporting a plurality of nozzles arranged along a horizontal cylindrical axis direction thereof and passing through opposite

cylindrical side faces to protrude downwards, so as to be rotatable about said cylindrical axis,

a flexible tube for communicating between an upper end of each of said nozzles and said liquid drawing section, and

5 a rotation mechanism for rotating said cylindrical support section and/or a slide mechanism for sliding said cylindrical support section in a horizontal direction.

July 11 17. An automatic separator/extractor according to claim 1, claim 15 or claim 16, wherein in said processing section, an incline angle, incline speed and/or incline timing of said combined incline mechanism, a movement direction and movement
10 amount by said relative movement mechanism, and a drawing speed and/or a drawing timing, are set by said operation/control section based on; the contents or purpose of an indicated process, a shape or size of a nozzle or vessel, the nature of a precipitate or solution and an amount of these and/or a level of these.

18. An automatic separator/extractor according to claim 13, wherein a liquid
15 extraction section for extracting liquid other than precipitate has an integration apparatus having drawing/discharge means for drawing and discharging fluid, and a plurality of nozzles which pass fluid thereinside by said drawing and discharging, and which are provided so as to be insertable into each well of said vessel, and said liquid extraction section draws liquid in a vessel mounted on said conveying means
20 and discharges this to another vessel mounted on said conveying means.

19. An automatic separator/extractor according to claim 18, wherein said integration apparatus has;

a main body provided with a plurality of cylinders corresponding to a plurality of wells provided in said vessel,

25 a plunger section provided with a plurality of push plungers which protrude so as to be insertable into each of said cylinders,

a plurality of nozzles provided beneath said cylinders for communicating with said cylinders, and

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a tip section having a plurality of pipette tips detachably fitted to said nozzles.

20. An automatic separator/extractor according to either one of claim 18 and claim 19, wherein said extraction section has; a moving means for moving said integration section between a vessel mounted on said conveying means and a vessel or a washing section for pipette tip washing provided apart from said conveying means.

21. An automatic separator/extractor according to claim 19, wherein said integration apparatus uses a link mechanism to attach or remove said tips to or from said nozzle section.

22. An automatic separator/extractor according to claim 18, wherein a drawing and discharging speed of said liquid extraction section, an insertion depth of a pipette tip in a vessel, a drawing and discharging timing, or a type of pipette to be used are set by said operation/control section based on the contents or purpose of a process, the nature or amount of liquid, precipitate, or target substance, or the shape or size of a vessel.

23. An automatic separator/extractor according to claim 3, wherein for said agitating section, individual through holes are bored in said mounting sections for mounting vessel on said conveying means, and at a secured position on a path at at least one location where each mounting section stops there is provided a vibration pin which passes through said through hole from the bottom side of the mounting section and which is moveable back and forth and which can be vibrated, and above a vessel which is mounted at the mounting section at said secured position there is provided a vessel holding section for pushing and holding said vessel which has been pushed upwards by advancing said vibration pin.

24. An automatic separator/extractor according to claim 23, wherein said vessel holding section of said agitating section is formed from a frame for contacting said vessel only at a rim on an upper face of the vessel, and the nozzles or tips of said dispensing section can be inserted from above said frame into said vessel which is beneath said frame.

25. An automatic separator/extractor according to either one of claim 22 and claim 23, wherein the vibration strength, vibration period pattern, vibration time and timing due to said agitating section are set by said operation/control section based on the nature or amount of liquid contained in a vessel, the shape or size of a vessel, and/or the contents or purpose of a process.

26. An automatic separator/extractor according to claim 1, wherein said vessel moving means moves said vessel between an incubator provided in addition to said conveying means and set at one or more temperatures, the mounting section of said conveying means and said separator.

27. An automatic separator/extractor according to claim 26, wherein movement origin and movement destination, movement timing, or movement speed of said vessel are set by said operation/control section based for example on the contents or purpose of a process, or a liquid amount contained in a vessel.

28. A method of controlling an automatic separator/extractor having with respect to an automatic separator/extractor having:

conveying means for conveying a vessel along a closed path, which has a plurality of mounting sections for mounting the vessels.

a dispensing section for dispensing a reagent or the like into said vessel,

a liquid processing section for removing and/or extracting liquid other than a precipitate inside said vessel,

a separator for performing separation with respect to contents inside said vessel which is mounted on said conveying means and/or a vessel which is installed away from said conveying means,

vessel moving means for bringing in and taking out said vessel with respect to the mounting sections of said conveying means and/or separator, and

an operation/control section for performing operation and control with respect to said conveying means, said dispensing section, said liquid processing section, said vessel moving means, and said separator, wherein the liquid processing section has: a

liquid drawing section, one or a plurality of nozzles communicated with said liquid drawing section, and which can be inserted into said vessel.

_____ a vertical movement mechanism for moving in a vertical direction said nozzles or vessel in order to insert said nozzles into said vessel or into each well of said vessel,

- 5 and a combined incline mechanism for inclining said nozzles and vessel in combination with respect to said vertical axis, in order to incline said vessel and draw in liquid from said nozzles without influencing a precipitate.

a step for analyzing instructions from outside,

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a step for agitating contents inside said vessel mounted on said conveying means according to instructions,

10 a step for bringing in or taking out said vessel with respect to the mounting
sections of conveying means and/or the separator according to instructions, and
 a separation step for performing separation according to instructions.

15 step for mounting a vessel containing a target substance which is combined with magnetic particles on a magnetic force means for generating a magnetic force and precipitating the magnetic particles according to instructions, and in moving said vessel to a position where there is no influence of magnetic force due to said magnetic force means or the like, and then with said vessel under the
20 influence of a magnetic force due to a magnetic force means other than said magnetic force means, or in a condition where a magnetic force of said magnetic force means is received, rotating said vessel and discarding liquid other than the magnetic particles and/or extracting liquid other than magnetic particles from the vessel.

25 a liquid drawing section, a plurality of nozzles communicated with said liquid
drawing section, and which can be inserted into each well of a microplate,
 a vertical movement mechanism for moving in a vertical direction said nozzles
or microplate in order to insert said nozzles into each well of said microplate,

a combined incline mechanism for inclining said nozzles and microplate in combination with respect to a vertical axis, and

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5 31 An integration apparatus having a tip section having;
a body provided with a plurality of cylinders corresponding to a plurality of
wells provided in a microplate,
a plunger section projectingly provided with a plurality of insertion rods which
are insertable in each of said cylinders,
0 a plurality of nozzles provided beneath each of said cylinders and
communicating with said cylinders, and
a plurality of pipette tips removably fitted to said nozzles, and
a cover plate for covering beneath the pipette tips in order to prevent fluid
dripping at times other than during drawing and discharging, which can be driven
5 back and forth.

a body provided with a plurality of cylinders corresponding to a plurality of wells provided in a microplate,

10 a plurality of nozzles provided beneath each of said cylinders and
communicating with said cylinders, and

a cover plate for covering beneath the pipette tips in order to prevent fluid dripping at times other than during drawing and discharging, which can be driven

15 back and forth.